Appl. No. 10/773,800
Response to Office Action Mailed June 3, 2005

PATENT

Amendments to the Drawings:

The attached sheet of drawings includes changes to Fig. 1 This sheet, which includes Fig. 1 replaces the original sheet including Fig. 1.

Attachment: Replacement Sheet
          Annotated Sheet Showing Changes

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REMARKS/ARGUMENTS

Claims 3, 12 and 13 are amended by this response. No claims have been canceled or added. Accordingly, claims 1-18 remain pending.

In the latest Office Action, the Examiner objected to Figure 1 and indicated that this figure should be designated by a legend such as "Prior Art". Applicant has now amended Figure 1 to include the legend, and it is respectfully asserted that the objection to Figure 1 has been overcome.

Claims 3 and 12-13 have been amended to correct typographical errors. Specifically, the claim term "predetermined" is now correctly spelled. Claim 12 has been amended to change the word "metrology" to the correct term "metal", as is recited in corresponding claim 2.

Turning now to address claim rejections based upon the prior art, claimed embodiments in accordance with the present invention relate to chips and methods for fabricating chips. In particular, Figure 2 (reproduced below) of the instant application illustrates a bump layer anchored to an underlying substrate by protrusions:

> An under bump metal layer ("UBM") 209 is overlying the surface region. A wetting layer 203 is formed overlying the under bump metal layer. The <u>wetting layer comprises a plurality of protrusions</u> extending out of the wetting layer and disposed spatially on the wetting layer. A bump layer 201 is formed overlying the wetting layer and is <u>mechanically coupled to the plurality of protrusions</u>. (Emphasis added; ¶[0016])
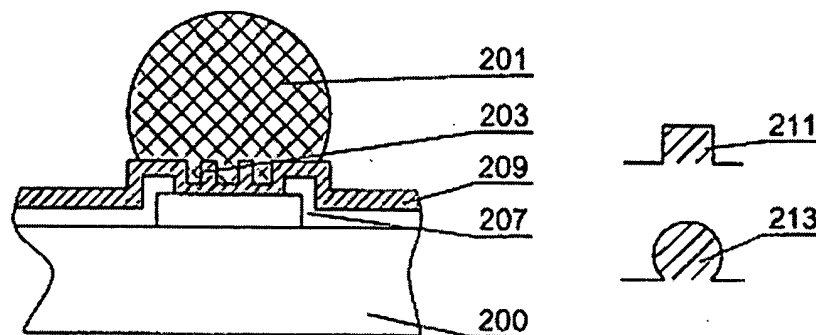
Each of the protrusions can also have a specific shape. Examples of shapes are shown by way of reference numerals 211 and 213. These shapes include rectangular and/or annular. The annular shape is hemispherical 213, which has a larger upper region and smaller lower region in a predefined configuration. Shape 213 <u>serves as an anchor to hold bonding layer 201 onto the surface of the bonding</u>

pad. Referring to Figure 3, each protrusion has a height 303 and width 301, which serves to anchor the bonding layer onto the wetting layer. (Emphasis added; ¶[0017])

Pending independent claims 1 and 11 accordingly recite as follows:

> 1. An integrated circuit chip comprising:
> . . . an under bump metal layer overlying the surface region;
> a wetting layer formed overlying the surface region, the wetting layer comprising a plurality of protrusions extending out of the wetting layer and disposed spatially on the wetting layer;
> a bump layer overlying the wetting layer and mechanically coupling the plurality of protrusions. (Emphasis added)
>
> * * *
>
> 11. A method for fabricating an integrated circuit chip comprising:
> . . . forming an under bump metal layer overlying the surface region;
> forming a wetting layer overlying the under bump metal layer, the wetting layer comprising a plurality of protrusions extending out of the wetting layer and disposed spatially on the wetting layer; and
> forming a bump layer overlying the wetting layer and mechanically coupling to the plurality of protrusions. (Emphasis added)

All of the claims have been rejected based upon published U.S. patent application no. 2004/0134974 to Oh et al. ("the Oh application"), either taken alone or in combination with other references. These claim rejections are traversed as follows.

As a threshold matter, the Examiner is reminded that certain claims stand rejected as anticipated by the Oh application:

> [t]he distinction between rejections based on 35 U.S.C. 102 and those based on 35 U.S.C. 103 should be kept in mind. Under the former, the claim is anticipated by the reference. No question of obviousness is present. In other words, for anticipation under 35 U.S.C. 102, the reference must teach every aspect of the claimed invention either explicitly or impliedly. Any feature not directly taught must be inherently present. (Emphasis added; MPEP 706.02)

Here, the Oh application contains absolutely no teaching, explicit or implied, regarding every element of the pending claims.

Specifically, the Oh application does show and describe a chip featuring projections that extend into an overlying bump structure. Unlike the claimed protrusions, however, the projections of the Oh application do not form part of an underlying wetting layer. Rather, the

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projections of the Oh application are formed as a separate layer overlying the wetting layer. The Oh application contains no teaching, explicit or even implied, that the projections comprise part of the wetting layer itself, as recited by the pending claims.

Based upon the failure of the Oh application to teach each and every aspect of the pending claims, it is respectfully asserted that these claims cannot legitimately be considered anticipated by that reference. The anticipation claim rejections are improper and should be withdrawn.

Regarding the obviousness claim rejections, the Examiner is respectfully reminded that in order to establish a prima facie case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." MPEP 2142. Here, the Oh application fails even to suggest fabricating protrusions as part of an underlying wetting layer in the claimed manner.

Specifically, as described above, the claimed protrusions of the wetting layer serve to physically anchor the bump. This role is reflected in the recitation in both independent claims 1 and 11 of "mechanical coupling" between protrusions and the bump layer. Integration of the claimed protrusions as part of the wetting layer serves to strengthen this mechanical coupling between the bump and underlying material.

By contrast, the projections of the Oh application are not created for anchoring purposes. Instead, the purpose of the projections of the Oh patent is to inhibit cracking of the bump:

> a cross-section of the plurality of projections 411 defines a regular mesh pattern in a plane parallel to the contact pad 402. Generally, any crack in the solder bump will tend to propagate horizontally through the bump material, and accordingly, the regular mesh pattern of metal projections 411 act as obstacles to crack propagation. These obstacles have the effect of increasing the crack resistance, and further lengthen the propagation path of any crack as it travels through the solder bump material, thus decreasing the likelihood device failure. (Emphasis added; ¶[0030])

Because the projections of the Oh application do not serve to anchor the bump, there would be no motivation to make them part of an underlying wetting layer in the manner of the pending claims. The Oh application therefore does not even suggest every element of the pending claims.

Finally, the lack of any teaching to form projections from an underlying wetting layer is not cured by inclusion of the other references relied upon by the Examiner. Specifically, neither U.S, patent no. 6,687,989 to Farnworth et al., nor U.S. patent no. 6,593,220 to Yu et al. teaches or even suggests a structure or method in which a bump is anchored by with projections of an underlying wetting layer.

Based upon the failure of the art relied upon by the Examiner to teach, or even suggest, every element of the pending claims, it is respectfully asserted that these claims cannot be considered anticipated or obviousness. The claim rejections are improper and should be withdrawn.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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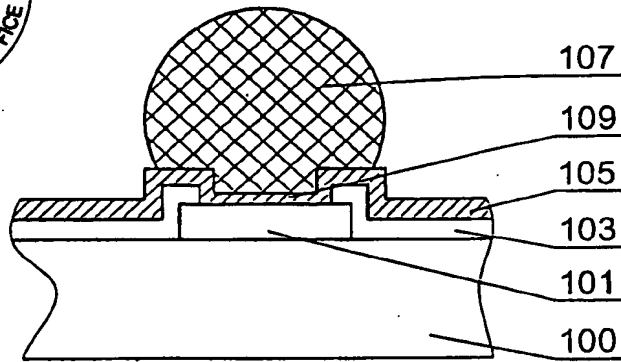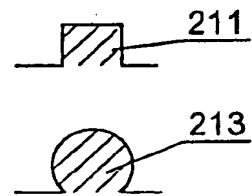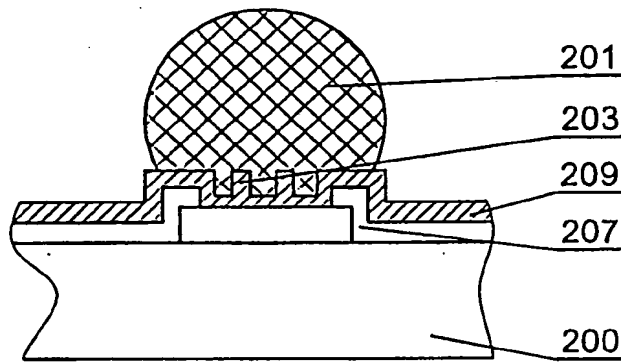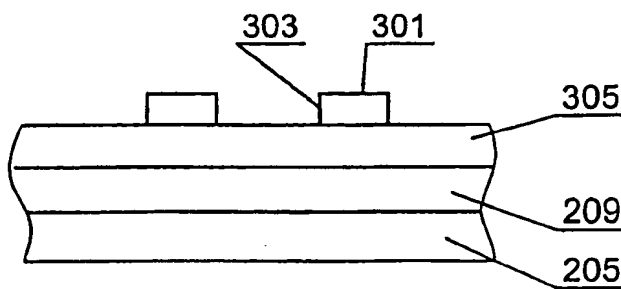Fax: 415-576-0300
Attachments
KJT:ejt
60575907 v1

OIPE
SEP 0 1 2005
PATENT & TRADEMARK OFFICE
IAP26

107
109
105
103
101
100

F I G. 1 (Prior Art)

201
203
209
207

211

213

200

F I G. 2

303   301
305
209
205

F I G. 3